PRESENTED BY: Anantha Madgula, Cardiology Fellow

5/20/2023

Left Ventricular GLS Analysis Performed Using IV Endocardial Enhancing Agent

AHN

No disclosures

Topics

1. Background
2. Hypothesis
3. Methods
4. Results
5. Conclusion

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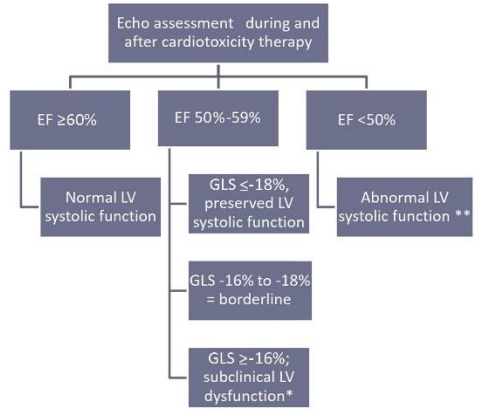
Background

Global Longitudinal Strain Adds Value

- The value of left ventricular global longitudinal strain (LV GLS) has been demonstrated across multiple domains of cardiology
- Cardio-oncology: detects subclinical LV systolic dysfunction
- Cardiomyopathy: amyloidosis, hypertrophic cardiomyopathy
- Adults with congenital heart diseases

CENTRAL ILLUSTRATION: Echocardiographic Evaluation During and After Cancer Treatment



Liu, J.E. et al. J Am Coll Cardiol CardioOnc. 2020;2(5):677-89.

Review > JACC Cardiovasc Imaging. 2018 Feb;11(2 Pt 1):260-274.
doi: 10.1016/j.jcmg.2017.11.017.

Assessment of Left Ventricular Function by Echocardiography: The Case for Routinely Adding Global Longitudinal Strain to Ejection Fraction

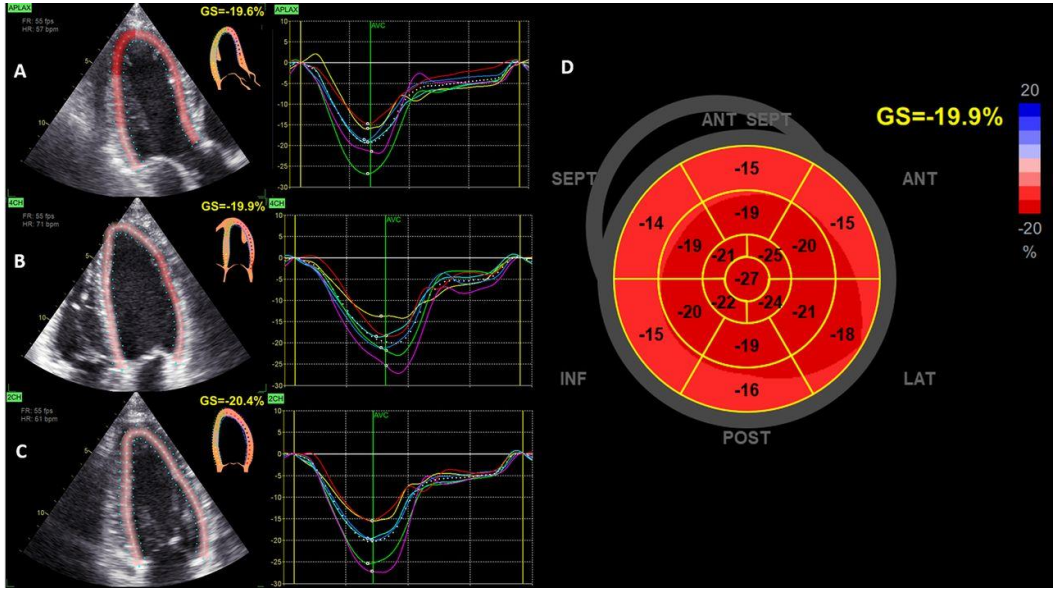
Elizabeth Potter [1], Thomas H Marwick [2]

doi:10.1016/j.jcmg.2017.11.017; doi: 10.1016/j.jcmg.2017.02.016; doi: 10.1016/j.jacc.2019.12.024; doi:10.1016/j.jacc.2018.02.064

Background

Speckle Tracking

- Speckle tracking – measures myocardial deformation
- Region of interest is identified – automated or manual
- Tracked through the cardiac cycle – systole and diastole
- Highly reproducible



doi.org/10.1186/s12947-019-0168-9

Limitations

“Unable to assess GLS due to suboptimal image quality leading to poor endocardial tracking”

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Hypothesis

When echocardiographic images are suboptimal, it is feasible to perform GLS analysis on contrast enhanced images

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Methods

Study Design

- Retrospective study
- Adults > 18 years
- AGH echo database queried:
- Period of interest: 1/1/22 to 7/31/22
- IV contrast + Strain analysis
- Three cardiology fellows
- IV contrast – Definity (Lantheus, MA)
- Software – TomTec (TomTec Imaging systems, Germany)

Methods

Study Design

- GLS analysis was performed on non-enhanced images. Correlation analysis was performed between this, and the values reported

- GLS analysis was then performed on contrast-enhanced images. Correlation was performed between this and GLS from non-enhanced images

- Inter-observer variability analysis performed on 15% of the sample to measure accuracy

Methods

GLS Analysis

- TomTec has an autostrain feature that can automatically detect the endocardium and measure GLS. Used on non-enhanced images
- Autostrain feature was unable to track GLS on enhanced images
- Views of interest i.e. A4C, A2C, and A3C were manually identified
- End-systolic and end-diastolic frames were identified and the endocardium was traced manually

Methods

Statistical Analysis

Statistical analysis performed using BlueSky software (version 7.19; BlueSky statistics LLC, Chicago, IL)

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Results

- 116 echo studies identified
- 93 studies were ordered to monitor for cardio-toxicity due to chemotherapeutic agents
- 57% of our study population was female
- 80 studies were done using a Phillips machine while the remaining were done using a GE machine

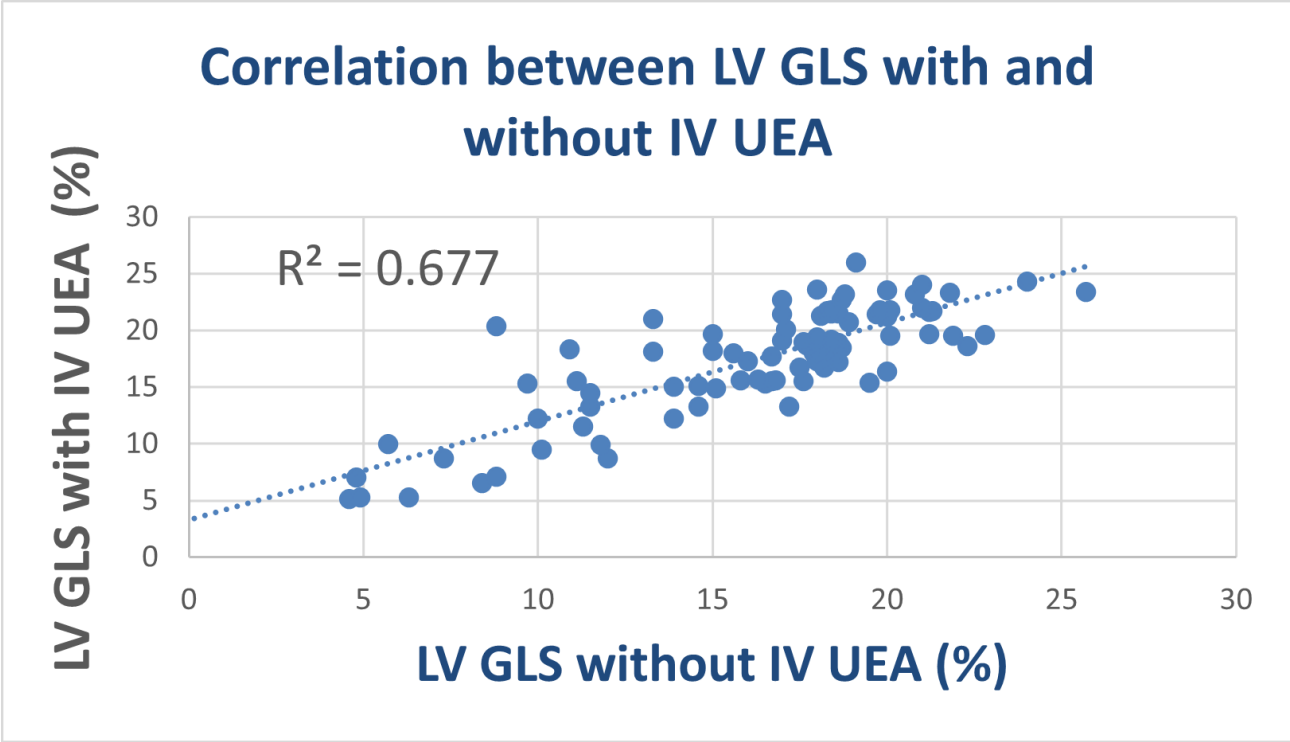
	Median	Interquartile Range
LV GLS without contrast (-%)	17.65	13.7 – 18.8
LV GLS with contrast (-%)	18.25	15.5 – 21.2
LVEF (%)	62	55-64
SBP (mmHg)	134	123 – 147
DBP (mmHg)	84	74 – 89
HR (bpm)	76	67 – 89
Age (years)	62	51 - 69

Results

Correlation

- GLS values reported by Cardiologists in the study report were compared with our GLS values without contrast – strong correlation with adjusted R2 = 0.84. Intraclass correlation coefficient (ICC) showed excellent agreement (ICC = 0.94, 95% CI = 0.92 –0.96)

- GLS values without contrast and with contrast were then compared and had a correlation coefficient R = 0.75. Linear regression model showed an R2 of 0.68 *(p<0.05)*



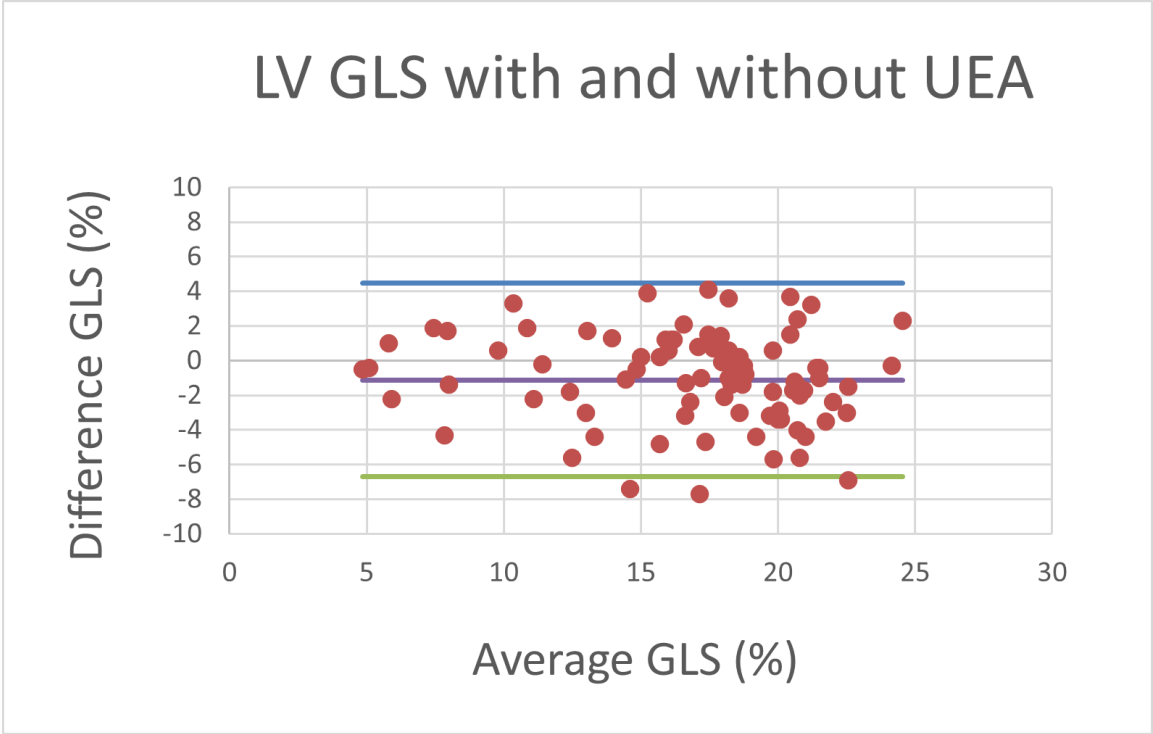
UEA = Ultrasound enhancing agent or contrast

Results

Reproducibility

- Bland-Altman plot is shown on the right

- ICC for two-way random effects with multiple raters for GLS with UEA performed by a different reader for a random sample of 19 studies was 0.92 (95% CI = 0.86 – 0.95) suggesting excellent reproducibility



UEA = Ultrasound enhancing agent or contrast

Results

Differences by Vendor

- Phillips vendor: Correlation coefficient between GLS with and without contrast using this vendor was 0.84 *(p<0.001)*

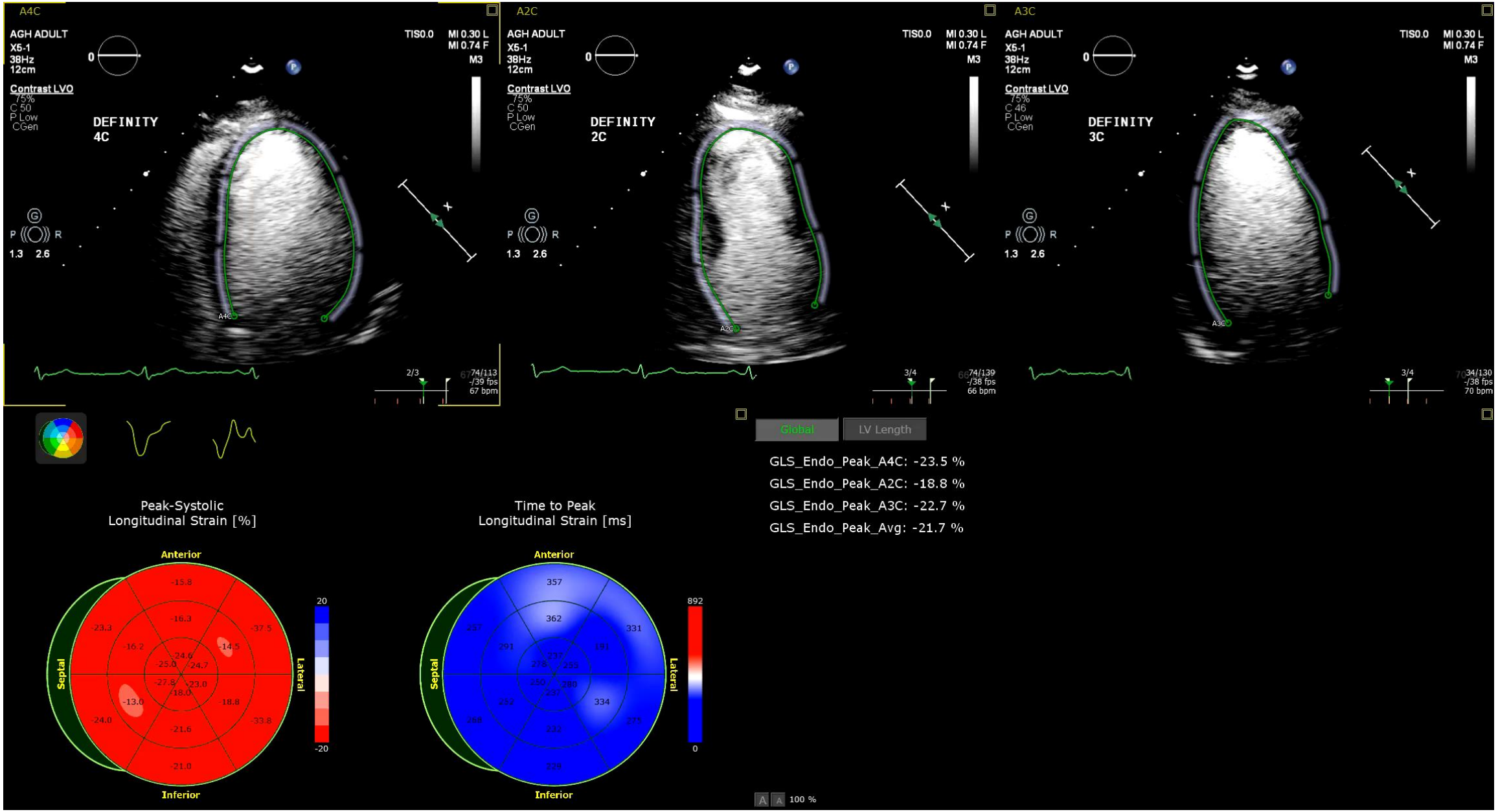
- GE vendor: Correlation coefficient between GLS with and without contrast using this vendor was 0.71 *(p<0.001)*

Strengths

- Real world analysis on pre-existing studies
- Non-modified image acquisition protocol
- Excellent reproducibility

Limitations

- We were unable to perform GLS analysis in six studies after contrast administration due to poor endocardial visibility
- Small sample size
- Time

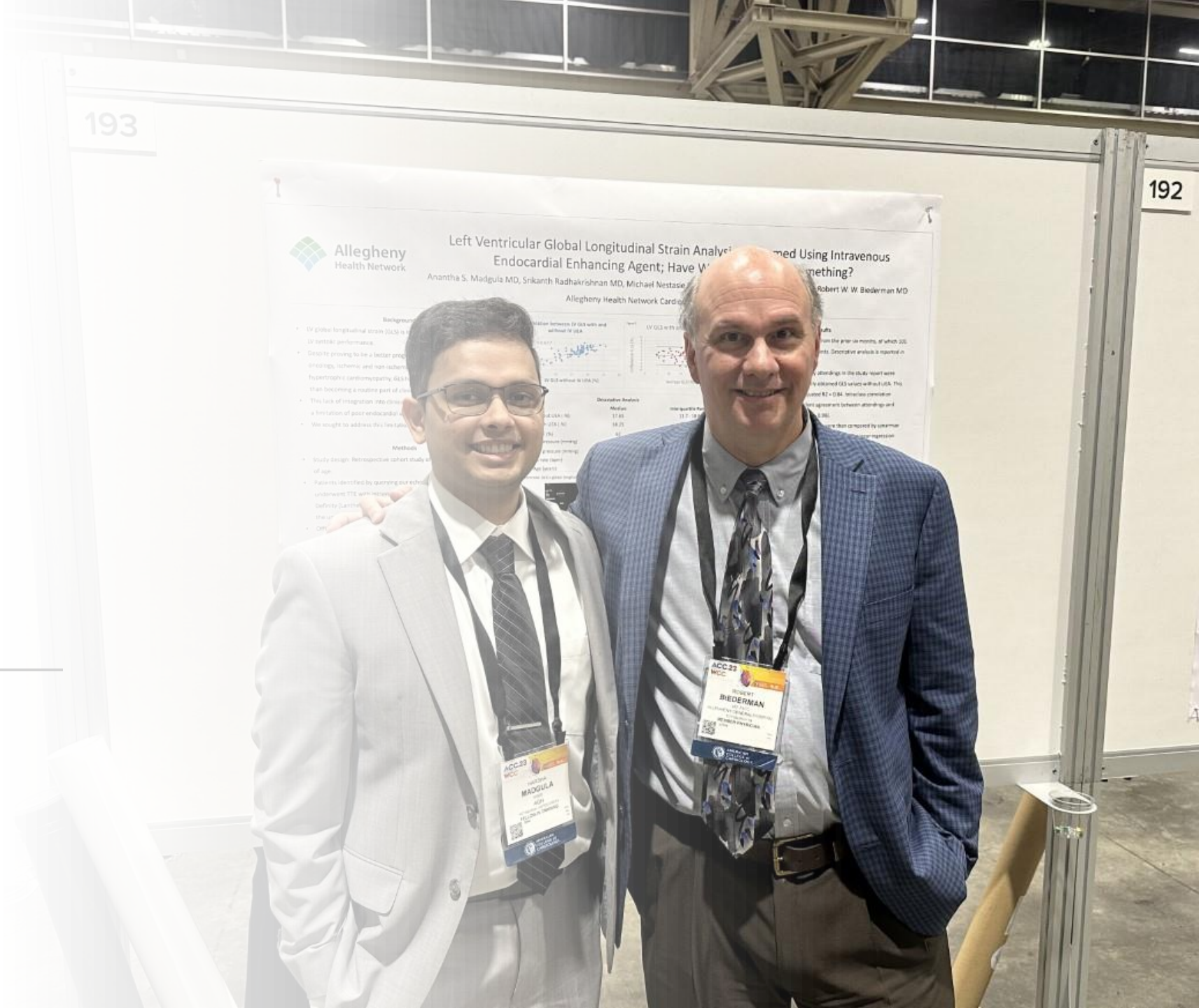

A4C
AGH ADULT
X5-1
38Hz
12cm
Contrast LVO
75%
C 50
P Low
CGen
DEFINITY
4C
TIS0.0
MI 0.30 L
MI 0.74 F
M3
1.3 2.6
A2C
DEFINITY
2C
A3C
DEFINITY
3C
C 46
Global
LV Length
GLS_Endo_Peak_A4C: -23.5 %
GLS_Endo_Peak_A2C: -18.8 %
GLS_Endo_Peak_A3C: -22.7 %
GLS_Endo_Peak_Avg: -21.7 %
Peak-Systolic
Longitudinal Strain [%]
Time to Peak
Longitudinal Strain [ms]
Anterior
Septal
Lateral
Inferior
20
-20
892
0
100 %

CONCLUSION

Conclusion

Performing LV GLS analysis on contrast enhanced images is feasible and reproducible.

THANK YOU!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Allegheny Health Network
Left Ventricular Global Longitudinal Strain Analys
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Endocardial Enhancing Agent; Have W
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Ananth S. Madgula MD, Srikanth Radhakrishnan MD, Michael Nestasie
Robert W. W. Biederman MD
Allegheny Health Network Cardi
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MADGULA
ACC.23
ROBERT
BIEDERMAN

Questions?